



Drainage Reports



PRELIMINARY DRAINAGE REPORT

FLEETWOOD 6 TOWNHOMES

NEC 1st Ave. & 69th St.

COS Case No. 35-Dr-2018

Zoning Case No. 19-ZN-2018

Plan # _____

Case # 19-ZN-2016 and 35-DR-2018

LDG PROJECT #1805133

Q-S # _____

☒ Accepted

☐ Corrections

DG _____ 1/10/19

Reviewed By _____ Date

Prepared for:

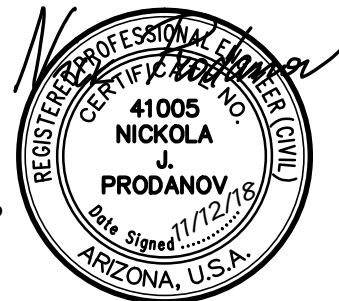
Mr. Lance D. Baker, AIA
Synectic Design Incorporated
1111 W. University Drive, Suite 104
Tempe, Arizona 85281

Submitted to:

City of Scottsdale
Stormwater Management
7447 E Indian School Road, Suite #125
Scottsdale, Arizona 85251

Prepared by:

Land Development Group, LLC
8808 N Central Ave., Ste 288
Phoenix, Arizona 85020
Contact: Nick Prodanov, PE, PMP
P: 602 889 1984



EXPIRES 06/30/2019

July 30, 2018

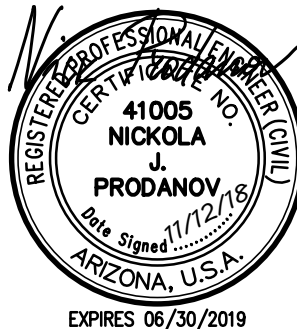
Rev. 1 November 5th, 2018

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July 30, 2018
Rev. 1 November 5th, 2018

1. INTRODUCTION

This preliminary drainage report and related design have been developed in accordance with the current Maricopa County and City of Scottsdale drainage ordinances, standards and policies.

The site consists of two developed parcels, with a total area of 0.480 acres, located at 6902 & 6908 E 1st Ave, Scottsdale, AZ 85251 (APNs 130-11-055 & 130-11-056). The property is bounded by 69th Street on the west, 1st Avenue on the south, an alley on the north and a vacant lot on the east side. The parcels are located within the Scottsdale Q.S. 16-44 and are being a part of previously approved plat – Taylors Addition, recorded in book 22 of maps, page 3, MCR, being a portion of the NE ¼ of the NW ¼ of the NE ¼ Section 27, Township 2 North, Range 4 East of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.

Refer to Appendix A-1 – Vicinity Map.

The proposed multifamily project will consist of six townhomes with common walls and shared driveway access on the east side. New site improvements include new site walls for privacy, paving, and landscape.

Based on provided City records, an office building development (Andante Law Group) was approved by the COS in 2016 (47-Dr-2016).

The analysis presented herein focuses on evaluating existing and proposed drainage conditions, as well as stormwater runoff resulting from a statistical evaluation of storm events of particular frequency, up to and including 100-year event as required by the Governing Agency. A storm event exceeding the 100-year will probably cause or create the risk of a greater storm impact than is presented and addressed herein. The procedures used herein are derived from, and performed with, currently accepted engineering methodologies and practices.

2. DESCRIPTION OF EXISTING DRAINAGE CONDITIONS AND CHARACTERISTICS

A field survey and visual reconnaissance inspection was conducted in June, 2018 to observe and collect information regarding the existing topographic characteristics, drainage conditions, document any local disturbances to the historic flows, and location and condition of the existing storm drainage structures and conveyance corridors. A topographic map was developed with a one-foot contour interval for the site and the adjacent streets. The elevation contours and survey spot elevations are tied to the section monuments and are based on the City of Scottsdale vertical datum (NAVD'88).

The overall existing terrain on site is flat and fully developed. 69th Street slopes in southerly direction, 1st Avenue slopes in easterly direction. Both streets are paved with asphalt and bounded by concrete vertical curb and gutter. Existing 5' wide sidewalk is located along 69th Street. The majority of the onsite generated surface drainage flows from north to south at an average slope of 0.5%. A portion of the existing drainage flows to the west and ultimately discharge onto 69th Street.

Site is located within the Lower Indian Bend Wash Area Drainage Master Study, Tempe/South Scottsdale Drainage Improvement Area. Based on the obtained study and its exhibits, no significant offsite flows run near or through the site.

3. FEMA FLOOD ZONE CLASSIFICATION

Site is located in Flood Zone "X" (shaded) according to Flood Insurance Rate Map (FIRM) #: 045012, Panel 2235, Suffix L, dated October 16th, 2013, as published by FEMA. The FIRM Panels defines Zone "X" as follows: *"Areas determined to be outside of the 0.2% annual chance floodplain"*.

See Appendix A-4 for FEMA Flood Insurance Rate Map and Appendix A-5 FCDMC Floodplain Viewer exhibits.

4. PROPOSED DRAINAGE PLAN

Grading and drainage plan shows the proposed grades and slopes away from the buildings. Runoff generated on site is conveyed via swales and valley gutters and ultimately discharged onto 69th Street and 1st Avenue. Due to slope of the site and grades of adjacent streets, the finish floor elevations of the units were stepped from north to south following the natural slope.

Computations have been performed to estimate the required on-lot storm water retention from 100-year storm. Precipitation data was derived from the NOAA Atlas 14, Volume 1, Version 4. This development will utilize the option to apply for a Stormwater Waiver and eliminate the on-lot retention required to be detained on site. 308 c.f. was the estimated required retention for this project. Pre-development runoff coefficient was estimated at 0.71. Post-development runoff coefficient was estimated at 0.85. See enclosed exhibit. No on-lot retention is proposed for this project. The volume of 308 c.f. will be requested in the waiver - see Appendix A-2 Grading and Drainage Plan, Appendix A-6 Drainage Calculations and Refer to Appendix A-7 – Request for Stormwater Storage Waiver.

Finish floor elevations of the proposed structures are set to a 1.0 ft min. above the adjacent high curb elevation and minimum 1.1 ft above the ultimate outfall of the site.

Proposed grading and drainage plan provide recommendation for the minimum top of footing elevations, which ultimately will need to be coordinated with and accepted by the project's structural and geotechnical engineers.

Grades are matched with the street elevations where the new driveway is proposed.

5. CONCLUSIONS AND RECOMMENDATIONS

The Grading and Drainage plan has been designed in conformance with the recommendations and results presented in this report as well as the City of Scottsdale, Maricopa County, Arizona State and Federal requirements and standards.

Regular inspections and maintenance of the wall openings and subsurface drainage systems after every major storm must be performed. Any obstructions of flow need to be promptly cleared out in order to keep the performance of the storm drain system as designed. It is the Owner's responsibility to inspect and properly maintain all on-site drainage structures.

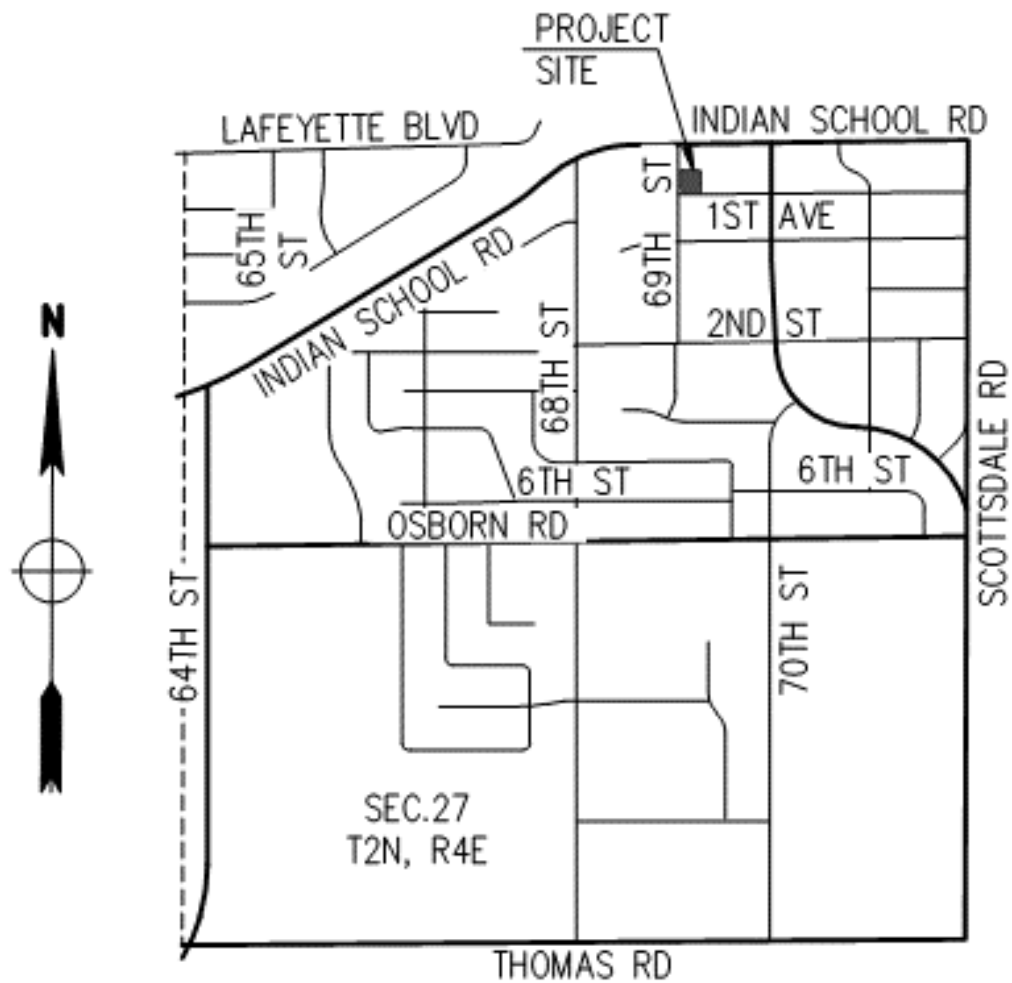
In conclusion, the project site has the potential to collect, convey, and discharge runoff effectively while meeting County, City guidelines. The proposed improvements do not impact drainage conditions of neighboring lots and will not result in significant changes to the existing drainage patterns or magnitudes.

6. REFERENCES

- Drainage Design Manual for Maricopa County, Arizona – Volume I Hydrology, Flood Control District of Maricopa County
- Drainage Design Manual for Maricopa County, Arizona – Volume II Hydraulics, Flood Control District of Maricopa County
- Drainage Policies and Standards Manual for Maricopa County, Arizona, Flood Control District of Maricopa County
- City of Scottsdale Design Standards & Policies Manual
- City of Scottsdale Stormwater Management System

APPENDIX A-1

Vicinity Map



APPENDIX A-2

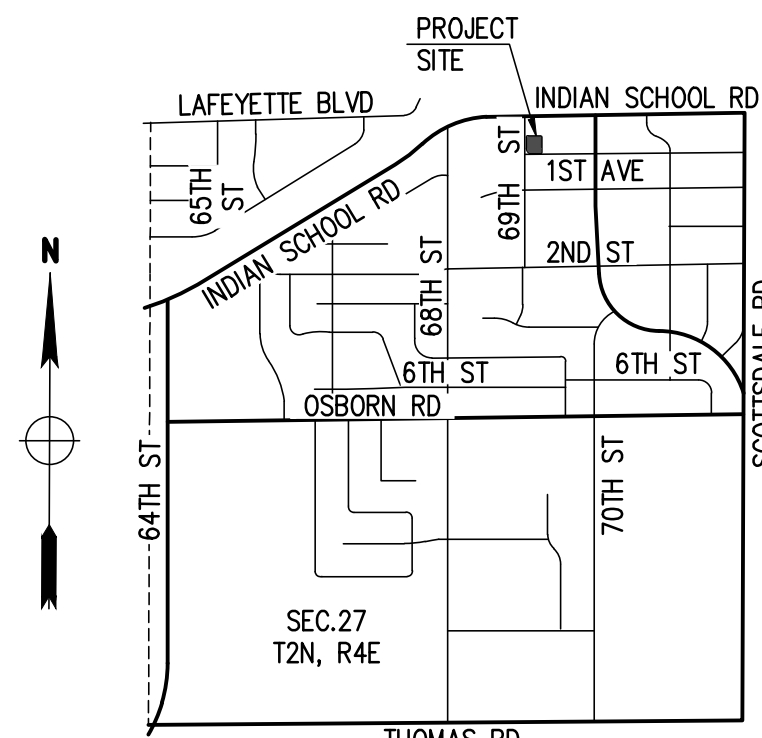
Preliminary Grading and Drainage Plan

PRELIMINARY GRADING & DRAINAGE PLAN

'FLEETWOOD 6 TOWNHOMES'

6902 & 6908 E 1ST AVE., SCOTTSDALE, AZ 85251

LOCATED IN A PORTION OF THE NE 1/4 OF THE NW 1/4 OF THE NE 1/4 OF SECTION 27, T.2N, R.4E
OF THE GILA & SALT RIVER BASE AND MERIDIAN, MARICOPA COUNTY, ARIZONA



VICINITY MAP
NTS

SITE DATA

APN: 130-11-055 & 130-11-056
ADDRESS: 6902 & 6908 E 1ST AVE.,
SCOTTSDALE, AZ 85251
ZONING: C-2
NET AREA: 12,950 S.F. (0.297 AC.)
GROSS AREA: 20,926 S.F. (0.480 AC.)
QS #: 16-44

CIVIL ENGINEER

LAND DEVELOPMENT GROUP, LLC
8808 N CENTRAL AVE, SUITE 288
PHOENIX, AZ 85020
CONTACT: NICK PRODANOV, PE
P: 602-889-1984

ARCHITECT

SYNETIC DESIGN, INC.
1111 W UNIVERSITY DRIVE, SUITE 104
TEMPE, AZ 85281
P: 480-948-9766
CONTACT: LANCE BAKER

OWNER

BLUEPRINT 6902, LLC,
P.O. BOX 16438,
SEATTLE, WA 98116

BASIS OF BEARINGS

THE MONUMENT LINE OF INDIAN SCHOOL ROAD, ALSO BEING THE NORTH LINE OF THE NORTHEAST QUARTER OF SECTION 27, USING A BEARING OF NORTH 89 DEGREES 08 MINUTES 22 SECONDS EAST, PER THE RECORD OF SURVEY, RECORDED IN BOOK 1176, PAGE 41, M.C.R.

BENCHMARK

BRASS CAP IN HANDHOLE AT THE INTERSECTION OF INDIAN SCHOOL AND SCOTTSDALE ROAD HAVING AN ELEVATION OF 1260.34 CITY OF SCOTTSDALE DATUM, NAVD 88

LEGAL DESCRIPTION

LOTS TWELVE (12) AND THIRTEEN (13), BLOCK ONE (1), TAYLORS ADDITION TO SCOTTSDALE, ACCORDING TO THE PLAT OF RECORD IN THE OFFICE OF THE MARICOPA COUNTY RECORDER IN BOOK 22 OF MAPS, PAGE 3.

FLOOD INSURANCE RATE MAP (FIRM) DATA

COMMUNITY #	PANEL #	SUFFIX	BASE FLOOD
045012	2235 OF 4425	L	ELEVATION
MAP #	PANEL DATE	ZONE	N/A
04013C	10/16/2013	X*	

*AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN

UTILITIES

WATER: CITY OF SCOTTSDALE
SANITARY SEWER: CITY OF SCOTTSDALE
ELECTRIC: ARIZONA PUBLIC SERVICE
TELEPHONE: CENTURY LINK, COX COMM.
NATURAL GAS: SOUTHWEST GAS
CABLE TV: CENTURY LINK, COX COMM.

RETENTION CALCULATIONS

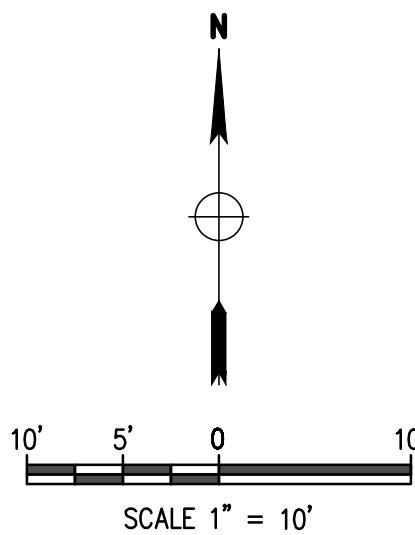
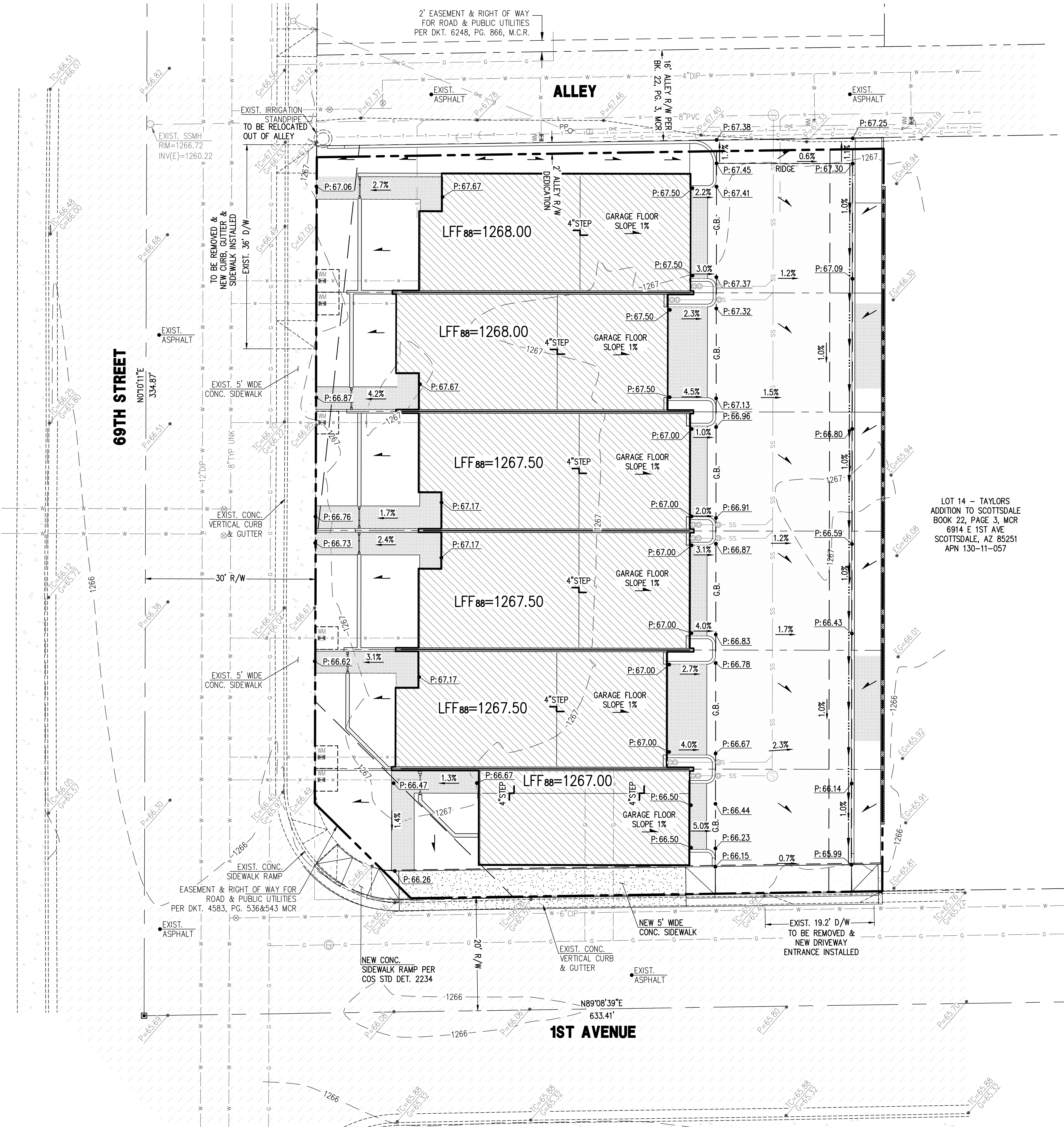
PRE VS. POST DEVELOPMENT RUNOFF FROM 100-YEAR, 2-HOUR STORM EVENT
 $V_r = D \times A \times (C - C_e) / 12$
 V_r = VOLUME REQUIRED
 V_p = VOLUME PROVIDED
 D = RAINFALL DEPTH = 2.16, INCHES (100-YR, 2HR RAINFALL DEPTH - NOAA ATLAS 14, VOL.1, VER. 5)
 $C = 0.85$ (PER PROPOSED SITE CONDITIONS)
 $C_e = 0.71$ (PER EXIST. SITE CURRENT CONDITIONS)
 A = AREA IN S.F. (12,950)
 V_w = VOLUME WAIVED
 $V_r = 326$ C.F. * $V_p = 0$ C.F.
*STORM WATER STORAGE WAIVER IN-LIEU FEE: V_w (308 C.F.) x \$3.00 = \$978

LEGEND

- SECTION CORNER
- 1/4 QUARTER
- SCRIBED "X" IN CONCRETE
- BRASS CAP IN HANDHOLE
- BRASS CAP FLUSH
- FOUND 1" IRON PIPE
- SET 1/2" REBAR & TAG OR AS NOTED
- CALCULATED POINT
- PROPERTY LINE
- EASEMENT LINE
- MONUMENT LINE
- SIGN
- LIGHT POLE
- WATER METER
- WATER VALVE
- FIRE HYDRANT
- CABLE TV RISER
- WATER METER BOX
- SEWER MANHOLE
- TELEPHONE PEDESTAL
- CATV, PHONE
- SEWER LINE
- WATER LINE
- ELECTRIC LINE
- COMMUNICATIONS LINE
- GAS LINE
- EXISTING CONTOUR
- EXIST. DRAINAGE FLOW
- EXIST. SPOT ELEVATION
- SLOPE DIRECTION
- PROPOSED SPOT ELEVATION
- PROPOSED CONTOUR
- FLOW LINE

ABBREVIATIONS

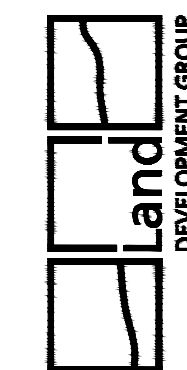
- ARV AIR RELEASE VALVE
- BC BACK OF CURB
- BSL BUILDING SETBACK LINE
- C11 CURVE LABEL
- C.B. CATCH BASIN
- C CENTERLINE
- COS CITY OF SCOTTSDALE
- DE DRAINAGE EASEMENT
- DG DECOMPOSED GRANITE
- EG EXISTING GRADE
- EL, ELEV ELEVATION
- ESMT EASEMENT
- EX, EXIST. EXISTING
- FCDMC FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
- FG FINISH GRADE
- FL FLOW LINE
- FND FOUND
- G GUTTER, GAS
- INV INVERT
- L11 LINE LABEL
- (M) MEASURED
- MAG MARICOPA ASSOCIATION OF GOVERNMENTS
- MCR MARICOPA COUNTY RECORDER
- MH MANHOLE
- P, PWMT PAVEMENT
- PUE PUBLIC UTILITY EASEMENT
- (R), REC. RECORDED
- R RADIUS
- R/W RIGHT OF WAY
- SD STORM DRAIN
- T TANGENT, TELEPHONE
- TC TOP OF CURB
- TG TOP OF GRATE
- TW TOP OF WALL
- V.G. VALLEY GUTTER
- W WEST, WATERLINE
- WDO WALL DRAINAGE OPENING
- WM WATER METER



PRELIMINARY GRADING & DRAINAGE PLAN

FLEETWOOD 6 TOWNHOMES 6902 & 6908 E 1ST AVE SCOTTSDALE, AZ 85251

P 602 889 1984 | F 602 445 9482
8808 N CENTRAL AVE, SUITE 288
PHOENIX, AZ 85020
PHOENIX @ LDENG.COM



P-GD
1 OF 1


APPENDIX A-3

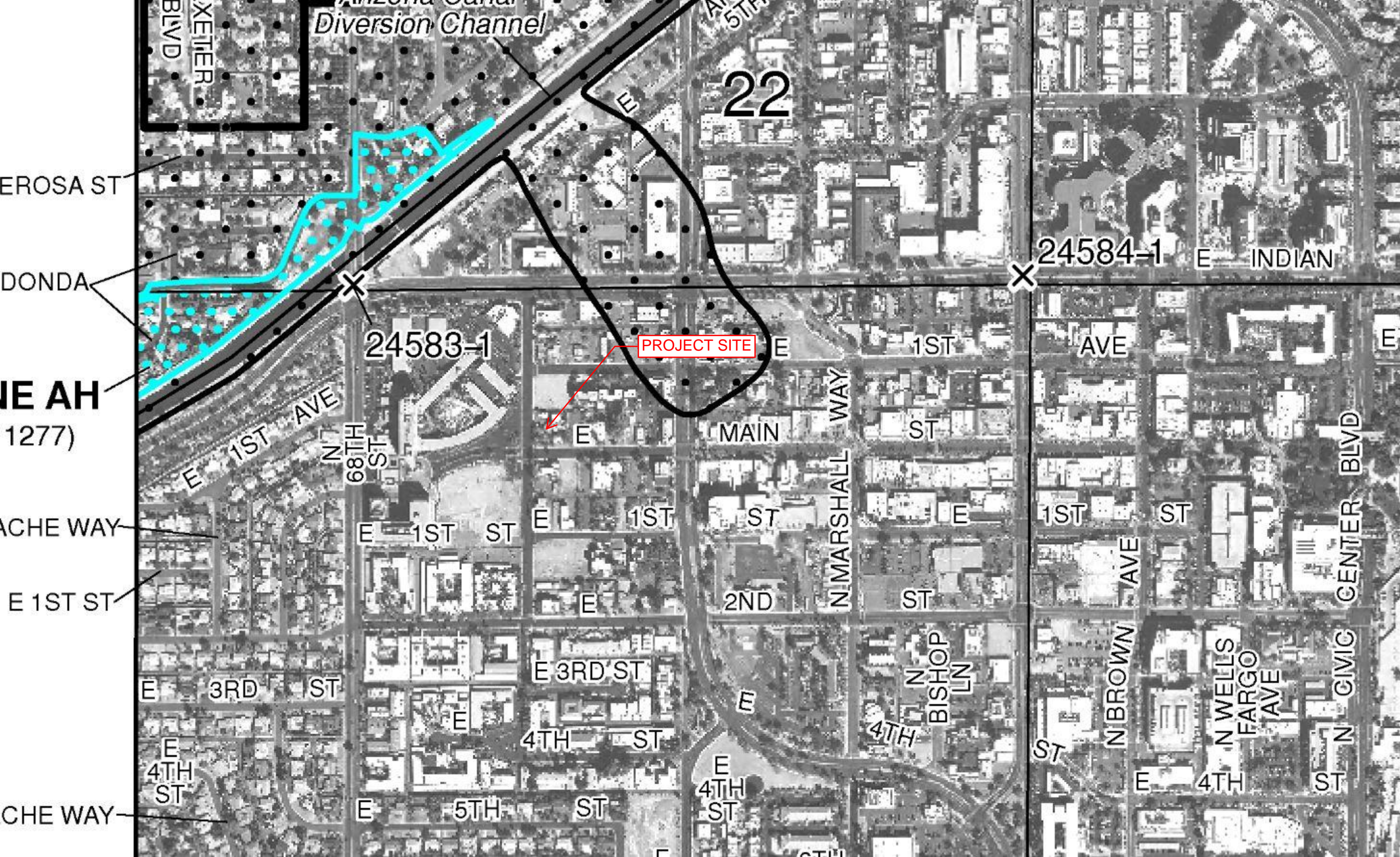
Aerial Topography Map Exhibit



APPENDIX A-4

FEMA FIRM Exhibit

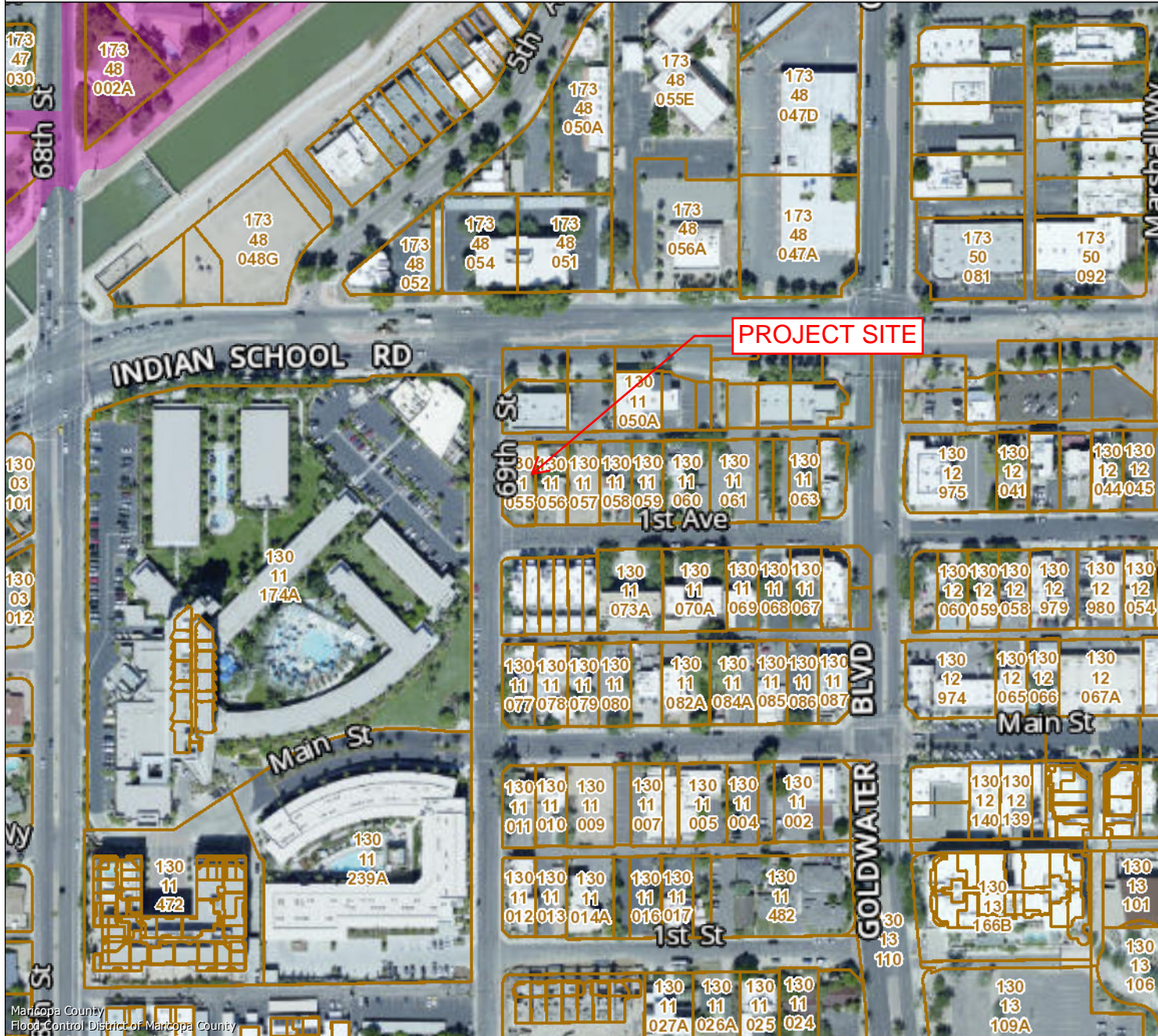
NFIP NATIONAL FLOOD INSURANCE PROGRAM	PANEL 2235L																			
	FIRM																			
	FLOOD INSURANCE RATE MAP																			
	MARICOPA COUNTY,																			
	ARIZONA																			
	AND INCORPORATED AREAS																			
	PANEL 2235 OF 4425																			
	(SEE MAP INDEX FOR FIRM PANEL LAYOUT)																			
	<u>CONTAINS:</u>																			
	<table><thead><tr><th><u>COMMUNITY</u></th><th><u>NUMBER</u></th><th><u>PANEL</u></th><th><u>SUFFIX</u></th></tr></thead><tbody><tr><td>MARICOPA COUNTY</td><td>040037</td><td>2235</td><td>L</td></tr><tr><td>MESA, CITY OF</td><td>040048</td><td>2235</td><td>L</td></tr><tr><td>SCOTTSDALE, CITY OF</td><td>045012</td><td>2235</td><td>L</td></tr><tr><td>TEMPE, CITY OF</td><td>040054</td><td>2235</td><td>L</td></tr></tbody></table>	<u>COMMUNITY</u>	<u>NUMBER</u>	<u>PANEL</u>	<u>SUFFIX</u>	MARICOPA COUNTY	040037	2235	L	MESA, CITY OF	040048	2235	L	SCOTTSDALE, CITY OF	045012	2235	L	TEMPE, CITY OF	040054	2235
<u>COMMUNITY</u>	<u>NUMBER</u>	<u>PANEL</u>	<u>SUFFIX</u>																	
MARICOPA COUNTY	040037	2235	L																	
MESA, CITY OF	040048	2235	L																	
SCOTTSDALE, CITY OF	045012	2235	L																	
TEMPE, CITY OF	040054	2235	L																	
<p>Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.</p>		MAP NUMBER 04013C2235L																		
		MAP REVISED OCTOBER 16, 2013																		
	Federal Emergency Management Agency																			



APPENDIX A-5

FCDMC Flood Plain Viewer

Floodplain Viewer



Parcel

Flood Zone

Not Within 100-Year Floodplain

A

AE

AH

AO

Regulatory Floodway

Pending Floodplain

A

AE

AH

AO

Floodway

Pending Floodplain Overlap

A

AE

AH

AO

Floodway

Maricopa County
Flood Control District of Maricopa County

Flood Control District of Maricopa County

2801 W Durango St
Phoenix, AZ 85009

(602) 506-2419
<http://www.fcd.maricopa.gov>

Unofficial Document

This document cannot be used for floodplain determinations. Current studies, erosion setbacks and other factors may also affect the floodplain status of the property. The information shown for pending floodplains are the best technical information available at this time to determine the 1% chance flood and are subject to change.



1:3,428

0 0.0275 0.055 0.11 mi

1 inch = 286 feet

APPENDIX A-6

Drainage Calculations

RETENTION CALCULATIONS

PRE VS. POST DEVELOPMENT RUNOFF FROM 100-YEAR, 2-HOUR STORM EVENT

$$V_r = D \times A \times (C - C_e) / 12$$

V_r = VOLUME REQUIRED

V_p = VOLUME PROVIDED

D = RAINFALL DEPTH = 2.16, INCHES (100-YR, 2HR RAINFALL DEPTH – NOAA ATLAS 14, VOL.1, VER. 5)

C = 0.85 (PER PROPOSED SITE CONDITIONS)

C_e = 0.71 (PER EXIST. SITE CURRENT CONDITIONS)

A = AREA IN S.F. (12,950)

V_w = VOLUME WAIVED

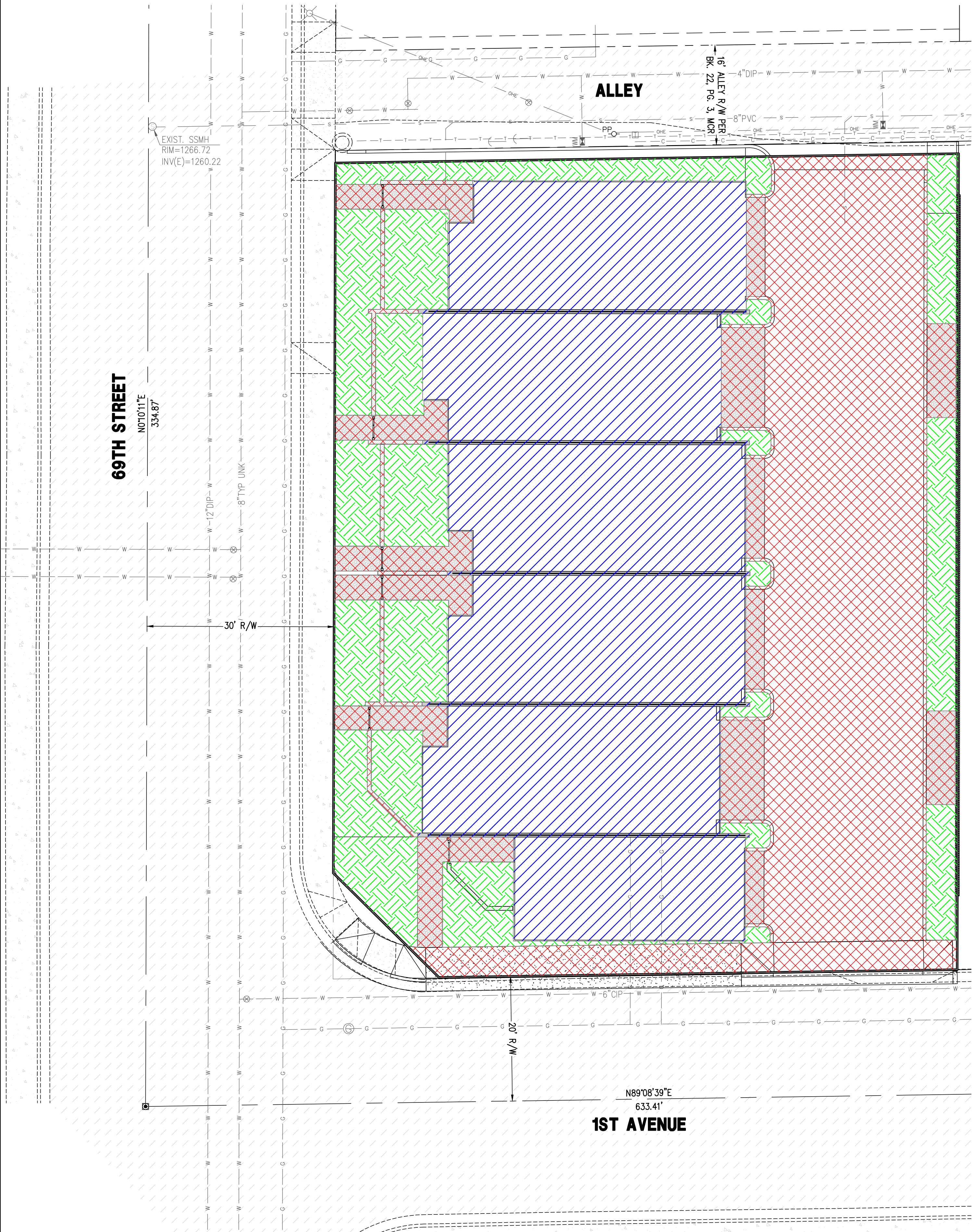
V_r = 326 C.F. * V_p = 0 C.F.

*STORM WATER STORAGE WAIVER IN-LIEU FEE: V_w (308 C.F.) x \$3.00 = \$978

See Grading and Drainage Plan for provided on-site surface retention.

WEIGHTED RUNOFF COEFFICIENT, Cw PROPOSED			
SURFACE TYPE	RUNOFF COEFFICIENT	AREA	C*AREA
	C	SF	
BUILDING	0.95	5,547	5,270
PAVEMENT	0.95	4,819	4,578
LANDSCAPE W/ NO IMPERVIOUS BARRIER	0.45	2,584	1,163
TOTAL		12,950	11,011
Cw = C * AREA / TOTAL AREA			0.85

PROPOSED CONDITIONS



PRELIMINARY 'C' VALUE EXHIBIT
'FLEETWOOD 6 TOWNHOMES'
6902 & 6908 E 1ST AVE., SCOTTSDALE, AZ 85251
LOCATED IN A PORTION OF THE NE 1/4 OF THE NW 1/4 OF THE NE 1/4 OF SECTION 27, T.2N, R.4E
OF THE GILA & SALT RIVER BASE AND MERIDIAN, MARICOPA COUNTY, ARIZONA

WEIGHTED RUNOFF COEFFICIENT, Cw EXISTING			
SURFACE TYPE	RUNOFF COEFFICIENT	AREA	C*AREA
	C	SF	
BUILDING-ROOF	0.95	5,449	5,177
PAVEMENT	0.95	1,265	1,202
LANDSCAPE W/ NO IMPERVIOUS BARRIER	0.45	6,236	2,806
TOTAL		12,950	9,185
Cw = C * AREA / TOTAL AREA			0.71

EXISTING CONDITIONS



DATE: 08/01/18
JOB: 1805133
VERSION: 1.1
PLOT DATE: 08/01/18

SCALE: 1" = 10'
DESIGNED BY: NP
DRAWN BY: DW
CHECKED BY: JF

REVISIONS:

PRELIMINARY 'C' VALUE EXHIBIT

FLEETWOOD 6 TOWNHOMES
6902 & 6908 E 1ST AVE
SCOTTSDALE, AZ 85251

P 602 889 1984 | F 602 445 9482
8808 N CENTRAL AVE., SUITE 288
PHOENIX, AZ 85020
PHOENIX @ LDENG.COM

LAND DEVELOPMENT GROUP

PRELIMINARY
NOT FOR CONSTRUCTION
DATE: 08/20/2018
EXHIBIT
1 OF 1



NOAA Atlas 14, Volume 1, Version 5
Location name: Scottsdale, Arizona, USA*
Latitude: 33.494°, Longitude: -111.9324°
Elevation: 1263.42 ft**
* source: ESRI Maps
** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps_&_aerials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	2.20 (1.85-2.68)	2.88 (2.42-3.49)	3.91 (3.28-4.74)	4.70 (3.91-5.66)	5.77 (4.73-6.92)	6.60 (5.33-7.88)	7.44 (5.90-8.87)	8.30 (6.48-9.89)	9.46 (7.18-11.3)	10.3 (7.69-12.3)
10-min	1.67 (1.40-2.03)	2.18 (1.84-2.66)	2.97 (2.49-3.60)	3.58 (2.98-4.31)	4.39 (3.59-5.27)	5.02 (4.06-6.00)	5.66 (4.49-6.74)	6.32 (4.93-7.52)	7.19 (5.47-8.58)	7.87 (5.86-9.40)
15-min	1.38 (1.16-1.68)	1.81 (1.52-2.20)	2.46 (2.06-2.98)	2.96 (2.46-3.56)	3.63 (2.97-4.36)	4.15 (3.35-4.96)	4.68 (3.71-5.58)	5.22 (4.07-6.22)	5.95 (4.52-7.09)	6.50 (4.84-7.76)
30-min	0.930 (0.780-1.13)	1.22 (1.03-1.48)	1.65 (1.38-2.00)	1.99 (1.65-2.40)	2.44 (2.00-2.93)	2.79 (2.26-3.34)	3.15 (2.50-3.75)	3.52 (2.74-4.18)	4.00 (3.04-4.77)	4.38 (3.26-5.23)
60-min	0.575 (0.483-0.700)	0.753 (0.635-0.915)	1.02 (0.857-1.24)	1.23 (1.02-1.49)	1.51 (1.24-1.82)	1.73 (1.40-2.07)	1.95 (1.55-2.32)	2.18 (1.70-2.59)	2.48 (1.88-2.95)	2.71 (2.02-3.24)
2-hr	0.333 (0.284-0.398)	0.432 (0.368-0.516)	0.578 (0.492-0.687)	0.690 (0.580-0.818)	0.842 (0.700-0.992)	0.960 (0.787-1.13)	1.08 (0.872-1.27)	1.20 (0.954-1.41)	1.37 (1.06-1.61)	1.50 (1.13-1.77)
3-hr	0.241 (0.204-0.290)	0.309 (0.264-0.374)	0.407 (0.345-0.489)	0.484 (0.407-0.578)	0.592 (0.491-0.703)	0.678 (0.554-0.803)	0.768 (0.616-0.909)	0.862 (0.680-1.02)	0.992 (0.759-1.17)	1.10 (0.818-1.30)
6-hr	0.146 (0.126-0.172)	0.185 (0.161-0.217)	0.237 (0.205-0.278)	0.279 (0.239-0.325)	0.335 (0.284-0.389)	0.380 (0.317-0.439)	0.427 (0.350-0.493)	0.474 (0.381-0.548)	0.539 (0.423-0.625)	0.590 (0.452-0.686)
12-hr	0.081 (0.071-0.094)	0.102 (0.090-0.119)	0.130 (0.113-0.150)	0.151 (0.131-0.175)	0.180 (0.154-0.208)	0.203 (0.172-0.233)	0.226 (0.188-0.260)	0.249 (0.205-0.287)	0.280 (0.225-0.324)	0.304 (0.240-0.355)
24-hr	0.049 (0.044-0.055)	0.062 (0.055-0.070)	0.080 (0.072-0.091)	0.095 (0.084-0.107)	0.115 (0.101-0.129)	0.131 (0.115-0.147)	0.148 (0.128-0.166)	0.165 (0.142-0.185)	0.189 (0.161-0.212)	0.207 (0.175-0.233)
2-day	0.026 (0.023-0.030)	0.034 (0.030-0.038)	0.044 (0.039-0.050)	0.053 (0.047-0.059)	0.064 (0.057-0.072)	0.074 (0.065-0.083)	0.084 (0.073-0.094)	0.094 (0.081-0.106)	0.108 (0.093-0.122)	0.120 (0.102-0.136)
3-day	0.019 (0.017-0.021)	0.024 (0.021-0.027)	0.031 (0.028-0.035)	0.037 (0.033-0.042)	0.046 (0.040-0.051)	0.053 (0.046-0.059)	0.060 (0.052-0.067)	0.068 (0.058-0.076)	0.078 (0.067-0.088)	0.087 (0.073-0.098)
4-day	0.015 (0.013-0.017)	0.019 (0.017-0.021)	0.025 (0.022-0.028)	0.030 (0.026-0.033)	0.037 (0.032-0.041)	0.042 (0.037-0.047)	0.048 (0.042-0.054)	0.054 (0.047-0.061)	0.063 (0.054-0.071)	0.071 (0.059-0.079)
7-day	0.009 (0.008-0.011)	0.012 (0.011-0.013)	0.016 (0.014-0.018)	0.019 (0.017-0.021)	0.023 (0.020-0.026)	0.027 (0.023-0.030)	0.030 (0.026-0.034)	0.034 (0.030-0.039)	0.040 (0.034-0.045)	0.045 (0.037-0.050)
10-day	0.007 (0.006-0.008)	0.009 (0.008-0.010)	0.012 (0.011-0.013)	0.014 (0.013-0.016)	0.018 (0.015-0.020)	0.020 (0.018-0.023)	0.023 (0.020-0.026)	0.026 (0.022-0.029)	0.030 (0.026-0.034)	0.033 (0.028-0.037)
20-day	0.004 (0.004-0.005)	0.006 (0.005-0.006)	0.007 (0.007-0.008)	0.009 (0.008-0.010)	0.011 (0.009-0.012)	0.012 (0.011-0.013)	0.013 (0.012-0.015)	0.015 (0.013-0.017)	0.017 (0.015-0.019)	0.018 (0.016-0.021)
30-day	0.003 (0.003-0.004)	0.004 (0.004-0.005)	0.006 (0.005-0.006)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.009 (0.008-0.010)	0.010 (0.009-0.012)	0.012 (0.010-0.013)	0.013 (0.011-0.015)	0.014 (0.012-0.016)
45-day	0.003 (0.002-0.003)	0.003 (0.003-0.004)	0.004 (0.004-0.005)	0.005 (0.005-0.006)	0.006 (0.006-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.009 (0.008-0.010)	0.010 (0.008-0.011)	0.011 (0.009-0.012)
60-day	0.002 (0.002-0.002)	0.003 (0.003-0.003)	0.004 (0.003-0.004)	0.004 (0.004-0.005)	0.005 (0.005-0.006)	0.006 (0.005-0.006)	0.006 (0.006-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.008 (0.007-0.009)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

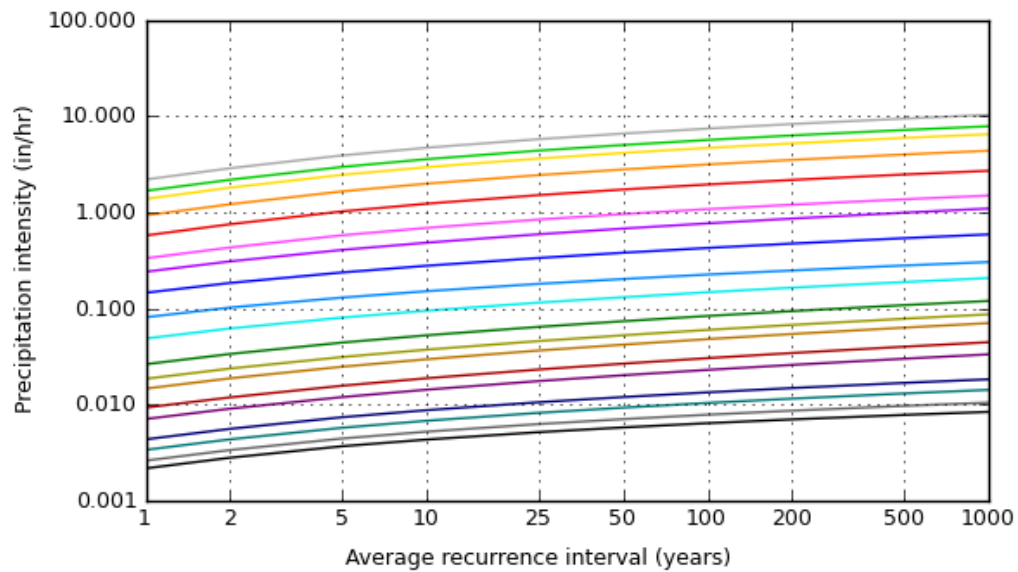
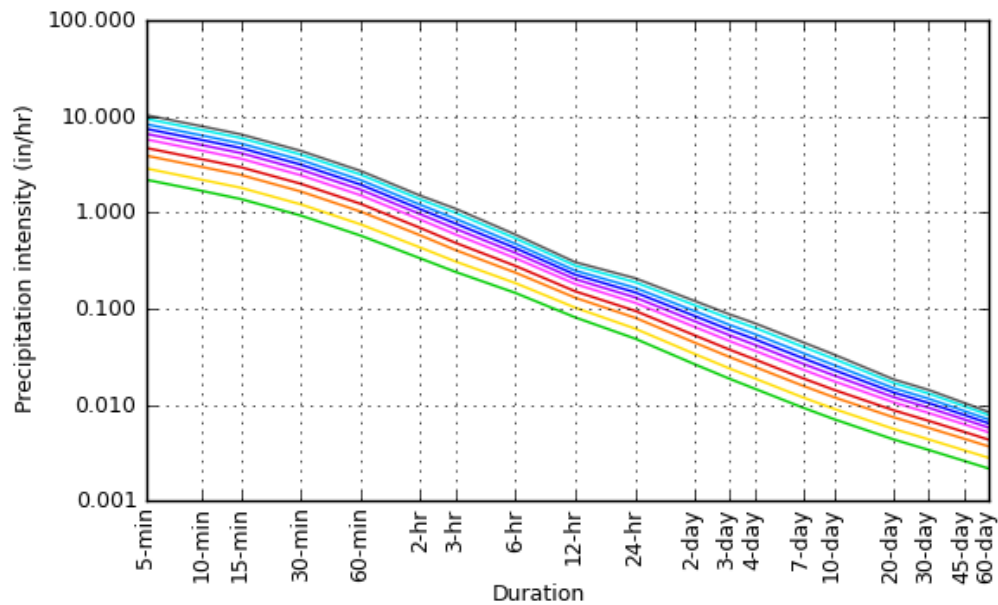
Please refer to NOAA Atlas 14 document for more information.

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PF graphical

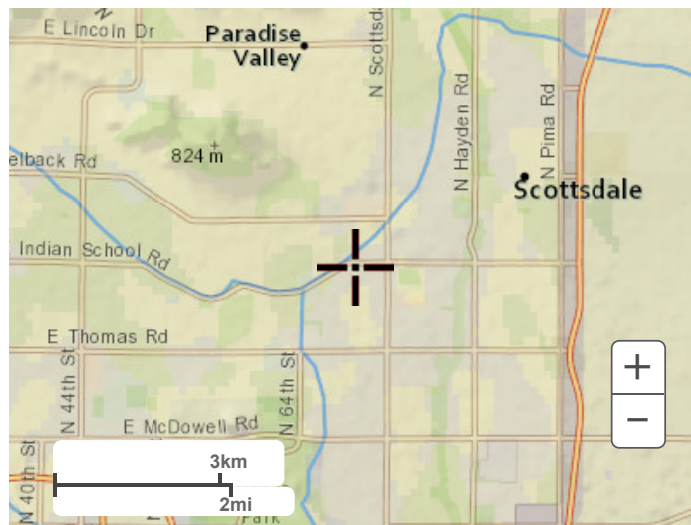
PDS-based intensity-duration-frequency (IDF) curves

Latitude: 33.4940°, Longitude: -111.9324°



Maps & aeriels

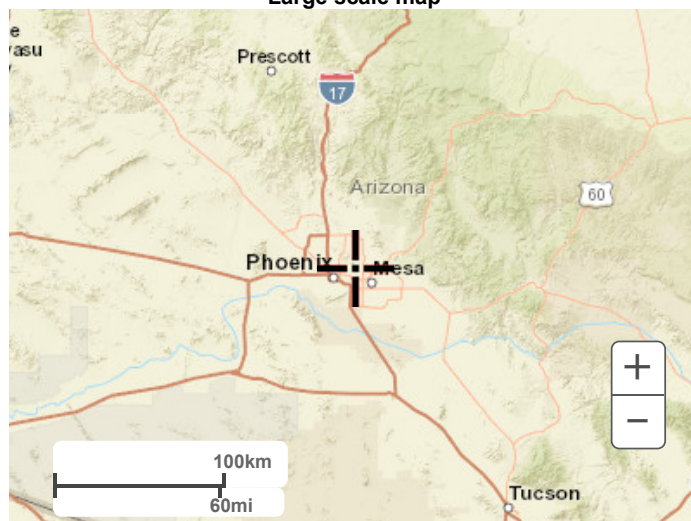
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial



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[National Oceanic and Atmospheric Administration](#)
[National Weather Service](#)
[National Water Center](#)
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

[Disclaimer](#)



NOAA Atlas 14, Volume 1, Version 5
Location name: Scottsdale, Arizona, USA*
Latitude: 33.494°, Longitude: -111.9324°
Elevation: 1263.42 ft**
* source: ESRI Maps
** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps_&_aerials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.183 (0.154-0.223)	0.240 (0.202-0.291)	0.326 (0.273-0.395)	0.392 (0.326-0.472)	0.481 (0.394-0.577)	0.550 (0.444-0.657)	0.620 (0.492-0.739)	0.692 (0.540-0.824)	0.788 (0.598-0.940)	0.862 (0.641-1.03)
10-min	0.279 (0.234-0.339)	0.364 (0.307-0.443)	0.495 (0.415-0.600)	0.596 (0.496-0.719)	0.732 (0.599-0.878)	0.837 (0.676-1.00)	0.944 (0.748-1.12)	1.05 (0.821-1.25)	1.20 (0.911-1.43)	1.31 (0.976-1.57)
15-min	0.345 (0.290-0.420)	0.452 (0.381-0.549)	0.614 (0.514-0.744)	0.739 (0.614-0.891)	0.907 (0.743-1.09)	1.04 (0.838-1.24)	1.17 (0.928-1.39)	1.31 (1.02-1.55)	1.49 (1.13-1.77)	1.63 (1.21-1.94)
30-min	0.465 (0.390-0.565)	0.608 (0.513-0.740)	0.827 (0.692-1.00)	0.995 (0.827-1.20)	1.22 (1.00-1.47)	1.40 (1.13-1.67)	1.58 (1.25-1.88)	1.76 (1.37-2.09)	2.00 (1.52-2.39)	2.19 (1.63-2.61)
60-min	0.575 (0.483-0.700)	0.753 (0.635-0.915)	1.02 (0.857-1.24)	1.23 (1.02-1.49)	1.51 (1.24-1.82)	1.73 (1.40-2.07)	1.95 (1.55-2.32)	2.18 (1.70-2.59)	2.48 (1.88-2.95)	2.71 (2.02-3.24)
2-hr	0.666 (0.569-0.795)	0.863 (0.736-1.03)	1.16 (0.983-1.37)	1.38 (1.16-1.64)	1.69 (1.40-1.99)	1.92 (1.57-2.26)	2.16 (1.75-2.54)	2.41 (1.91-2.82)	2.74 (2.12-3.21)	2.99 (2.27-3.54)
3-hr	0.724 (0.614-0.870)	0.929 (0.793-1.12)	1.22 (1.04-1.47)	1.45 (1.22-1.74)	1.78 (1.47-2.11)	2.04 (1.66-2.41)	2.31 (1.85-2.73)	2.59 (2.04-3.06)	2.98 (2.28-3.52)	3.29 (2.46-3.91)
6-hr	0.873 (0.756-1.03)	1.11 (0.962-1.30)	1.42 (1.23-1.66)	1.67 (1.43-1.95)	2.01 (1.70-2.33)	2.28 (1.90-2.63)	2.56 (2.10-2.95)	2.84 (2.28-3.28)	3.23 (2.53-3.74)	3.53 (2.71-4.11)
12-hr	0.977 (0.855-1.13)	1.23 (1.08-1.44)	1.57 (1.36-1.81)	1.82 (1.58-2.11)	2.17 (1.86-2.50)	2.44 (2.07-2.81)	2.72 (2.27-3.13)	3.00 (2.47-3.45)	3.37 (2.71-3.91)	3.67 (2.89-4.28)
24-hr	1.17 (1.05-1.32)	1.49 (1.33-1.68)	1.93 (1.72-2.18)	2.28 (2.02-2.56)	2.76 (2.43-3.11)	3.14 (2.75-3.53)	3.54 (3.08-3.97)	3.95 (3.41-4.44)	4.53 (3.86-5.08)	4.98 (4.20-5.60)
2-day	1.26 (1.13-1.43)	1.62 (1.44-1.82)	2.12 (1.89-2.39)	2.53 (2.24-2.84)	3.09 (2.73-3.47)	3.54 (3.11-3.98)	4.02 (3.50-4.52)	4.51 (3.90-5.08)	5.21 (4.45-5.87)	5.76 (4.88-6.51)
3-day	1.34 (1.19-1.51)	1.71 (1.52-1.93)	2.25 (2.00-2.53)	2.69 (2.38-3.02)	3.30 (2.91-3.70)	3.79 (3.32-4.25)	4.32 (3.75-4.84)	4.87 (4.20-5.47)	5.64 (4.80-6.34)	6.26 (5.28-7.06)
4-day	1.41 (1.25-1.59)	1.80 (1.60-2.04)	2.38 (2.11-2.68)	2.85 (2.52-3.20)	3.51 (3.08-3.94)	4.04 (3.53-4.53)	4.61 (4.00-5.17)	5.22 (4.49-5.86)	6.07 (5.16-6.82)	6.77 (5.69-7.61)
7-day	1.57 (1.39-1.77)	2.00 (1.78-2.26)	2.64 (2.34-2.98)	3.16 (2.80-3.56)	3.90 (3.43-4.38)	4.49 (3.92-5.04)	5.12 (4.44-5.75)	5.79 (4.98-6.51)	6.73 (5.72-7.57)	7.49 (6.30-8.45)
10-day	1.70 (1.51-1.92)	2.18 (1.94-2.45)	2.87 (2.55-3.23)	3.44 (3.04-3.86)	4.22 (3.71-4.73)	4.85 (4.24-5.43)	5.52 (4.79-6.18)	6.22 (5.36-6.98)	7.21 (6.14-8.08)	8.00 (6.74-8.99)
20-day	2.09 (1.87-2.34)	2.69 (2.40-3.01)	3.55 (3.17-3.97)	4.20 (3.74-4.69)	5.08 (4.50-5.67)	5.76 (5.08-6.42)	6.44 (5.65-7.19)	7.14 (6.23-7.98)	8.08 (6.99-9.05)	8.81 (7.56-9.88)
30-day	2.44 (2.17-2.74)	3.14 (2.80-3.52)	4.14 (3.68-4.63)	4.90 (4.35-5.47)	5.92 (5.23-6.60)	6.70 (5.89-7.47)	7.51 (6.57-8.36)	8.32 (7.25-9.27)	9.42 (8.14-10.5)	10.3 (8.81-11.5)
45-day	2.83 (2.53-3.16)	3.64 (3.26-4.07)	4.80 (4.29-5.36)	5.66 (5.04-6.32)	6.78 (6.02-7.57)	7.63 (6.76-8.52)	8.49 (7.49-9.49)	9.35 (8.21-10.5)	10.5 (9.13-11.8)	11.3 (9.82-12.7)
60-day	3.13 (2.81-3.49)	4.04 (3.63-4.51)	5.32 (4.76-5.92)	6.24 (5.58-6.95)	7.45 (6.64-8.29)	8.34 (7.41-9.29)	9.24 (8.17-10.3)	10.1 (8.91-11.3)	11.3 (9.87-12.6)	12.1 (10.6-13.6)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

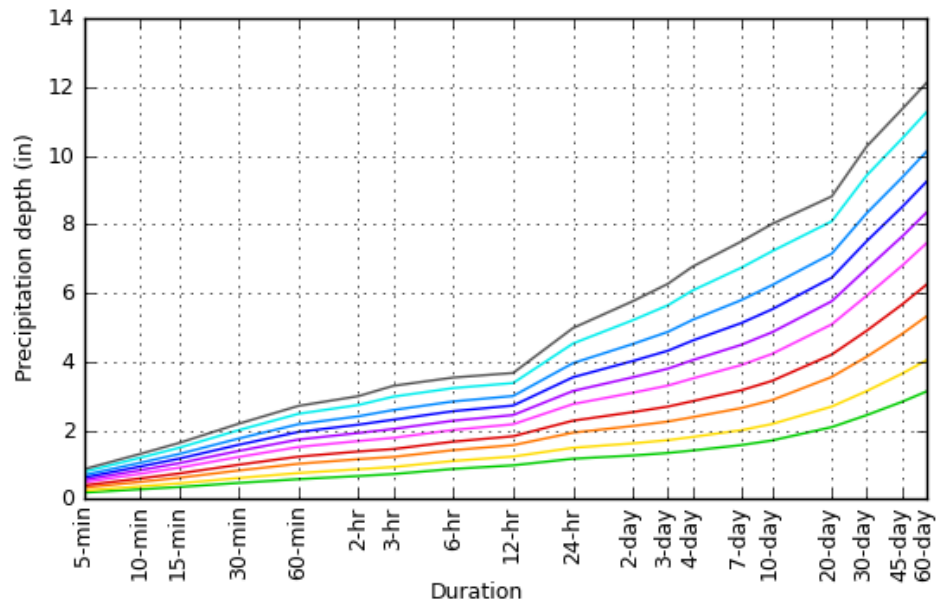
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

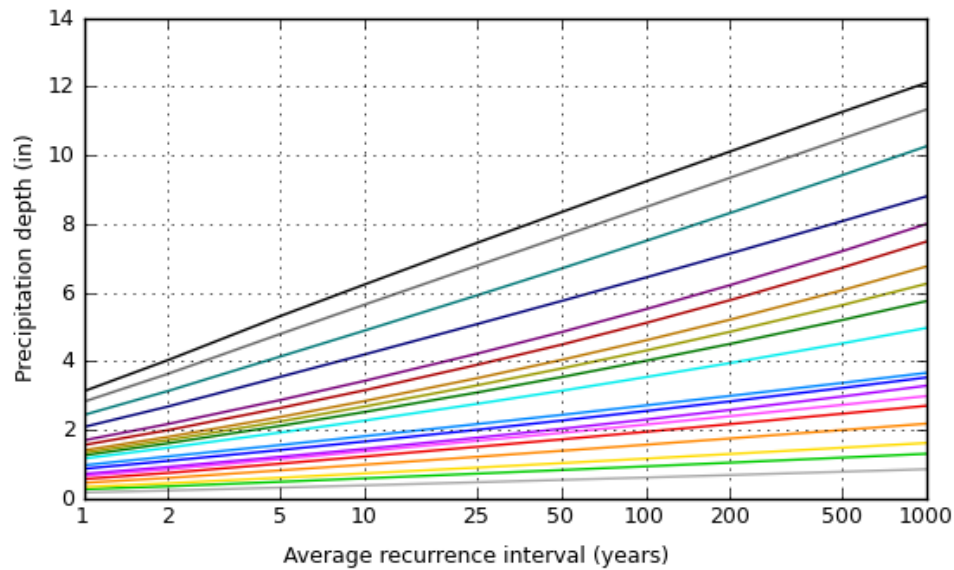
[Back to Top](#)

PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 33.4940°, Longitude: -111.9324°



Average recurrence interval (years)
1
2
5
10
25
50
100
200
500
1000



Duration	
5-min	2-day
10-min	3-day
15-min	4-day
30-min	7-day
60-min	10-day
2-hr	20-day
3-hr	30-day
6-hr	45-day
12-hr	60-day
24-hr	

Maps & aerials

Small scale terrain

APPENDIX A-7

Request for Stormwater Storage Waiver



Request for Stormwater Storage Waiver

City of Scottsdale Case Numbers:

____ - PA - ____ - ZN - ____ - UP - ____ - DR - ____ - PP - ____ PC# _____

The applicant/developer must complete and submit this form to the city for processing and obtain approval of waiver request **before submitting improvement plans**. Denial of the waiver may require the developer to submit a revised site plan to the Development Review Board.

Date _____ Project Name _____
Project Location _____
Applicant Contact _____ Company Name _____
Phone _____ Fax _____ E-mail _____
Address _____

Waiver Criteria

A project must meet at least one of three criteria listed below for the city to consider waiving some or all required stormwater storage. **However, regardless of the criteria, a waiver will only be granted if the applicant can demonstrate that the effect of a waiver will not increase the potential for flooding on any property.** Check the applicable box and provide a signed engineering report and supporting engineering analysis that demonstrate the project meets the criteria and that the effect of a waiver will not increase the potential for flooding on any property.

If the runoff for the project has been included in a storage facility at another location, the applicant must demonstrate that the stormwater storage facility was specifically designed to accommodate runoff from the subject property and that the runoff will be conveyed to this location through an adequately designed conveyance facility.

- ☐ 1. The development is adjacent to a conveyance facility that an engineering analysis shows is designed and constructed to handle the additional runoff from the site as a result of development.
- ☐ 2. The development is on a parcel less than one-half acre in size.
- ☐ 3. Stormwater storage requirements conflict with requirements of the Environmentally Sensitive Lands Ordinance (ESLO).

For a full storage waiver, a conflict with ESLO is limited to:

- Property located in the hillside landform as defined in the city Zoning Ordinance
- Property in the upper desert landform that has a land slope steeper than 5% as defined in the city Zoning Ordinance
- Property within the ESL zoning overlay district where the only viable location for a stormwater storage basin requires blasting

This full waiver only applies to those portions of property meeting one of these three requirements.

Partial waivers are available for projects or portions of properties within the Environmentally Sensitive Lands Zoning Overlay District, not meeting any of the three full waiver criteria above, if post-development peak discharge rates do not exceed pre-development conditions, based on the 10- and 100-year storm events.

By signing below, I certify that the stated project meets the waiver criteria selected above as demonstrated by the attached documentation.

Nick Prodanov

Engineer

Date

Planning, Neighborhood & Transportation Division

7447 E Indian School Road, Suite 105, Scottsdale, AZ 85251 • Phone: 480-312-2500 • Fax: 480-312-7781



Request for Stormwater Storage Waiver

City of Scottsdale Case Numbers:

____ - PA - ____ - ZN - ____ - UP - ____ - DR - ____ - PP - ____ PC# ____

CITY STAFF TO COMPLETE THIS PAGE

Project Name _____

Check Appropriate Boxes:

☐ Meets waiver criteria (specify): ☐ 1 ☐ 2 ☐ 3

☐ Recommend approve waiver.

☐ Recommend deny waiver:

☐ None of waiver criteria met.

☐ Downstream conditions prohibit waiver of any storage.

☐ Other:

Explain: _____

☐ Return waiver request:

☐ Insufficient data provided.

☐ Other: _____

Explain: _____

Recommended Conditions of Waiver:

☐ All storage requirements waived.

☐ Post-development peak discharge rates do not exceed pre-development conditions.

☐ Other:

Explain: _____

☐ **Waiver approved per above conditions.**

☐ **Waiver denied.**

Floodplain Administrator or Designee

Date

Planning, Neighborhood & Transportation Division

7447 E Indian School Road, Suite 105, Scottsdale, AZ 85251 ♦ Phone: 480-312-2500 ♦ Fax: 480-312-7781



Request for Stormwater Storage Waiver

City of Scottsdale Case Numbers:

____ - PA - ____ - ZN - ____ - UP - ____ - DR - ____ - PP - ____ PC# _____

In-Lieu Fee and In-Kind Contributions

In-lieu fees are only applicable to projects where post-development peak discharge rates exceed pre-development levels, based on the 10- and 100-year storm events. If the city grants a waiver, the developer is required to calculate and contribute an in-lieu fee based on what it would cost the city to provide a storage basin, sized as described below, including costs such as land acquisition, construction, landscaping, design, construction management, and maintenance over a 75-year design life. The fee for this cost is \$3.0 per cubic foot of stormwater storage for a virtual storage basin designed to mitigate the increase in runoff associated with the 100-year/2-hour storm event. The applicant may submit site-specific in-lieu fee calculations subject to the Floodplain Administrator's approval.

The Floodplain Administrator considers in-kind contributions on a case-by-case basis. An in-kind contribution can serve as part of or instead of the calculated in-lieu fee. In-kind contributions must be stormwater related and must constitute a public benefit. In-lieu fees and in-kind contributions are subject to the approval of the Floodplain Administrator or designee.

Project Name _____

The waived stormwater storage volume is calculated using a simplified approach as follows:

$V = \Delta CRA$; where

V = stormwater storage volume required, in cubic feet,

ΔC = increase in weighted average runoff coefficient over disturbed area ($C_{\text{post}} - C_{\text{pre}}$),

R = 100-year/2-hour precipitation depth, in feet (DSPM, Appendix 4-1D, page 11), and

A = area of disturbed ground, in square feet

Furthermore,

$R =$ _____

$\Delta C =$ _____

$V_w = V - V_p$; where

$A =$ _____

V_w = volume waived,

$V =$ _____

V = volume required, and

$V_p =$ _____

V_p = volume provided

$V_w =$ _____

☐ An in-lieu fee will be paid, based on the following calculations and supporting documentation:

In-lieu fee (\$) = V_w (cu. ft.) x \$3.0 per cubic foot = _____

☐ An in-kind contribution will be made, as follows:

☐ No in-lieu fee is required. Reason:

Approved by:

Floodplain Administrator or Designee

Date

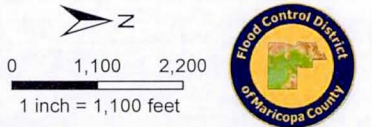
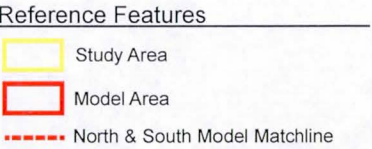
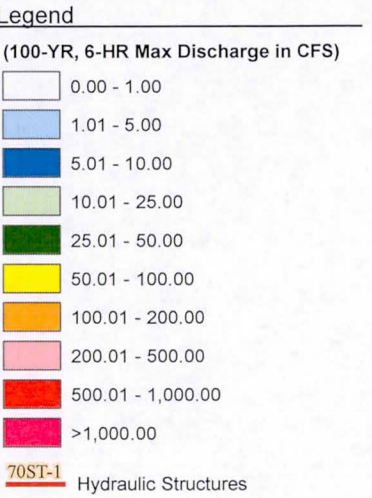
Planning, Neighborhood & Transportation Division

7447 E Indian School Road, Suite 105, Scottsdale, AZ 85251 ♦ Phone: 480-312-2500 ♦ Fax: 480-312-7781

APPENDIX A-8

Lower Indian Bend Wash ADMS Excerpt

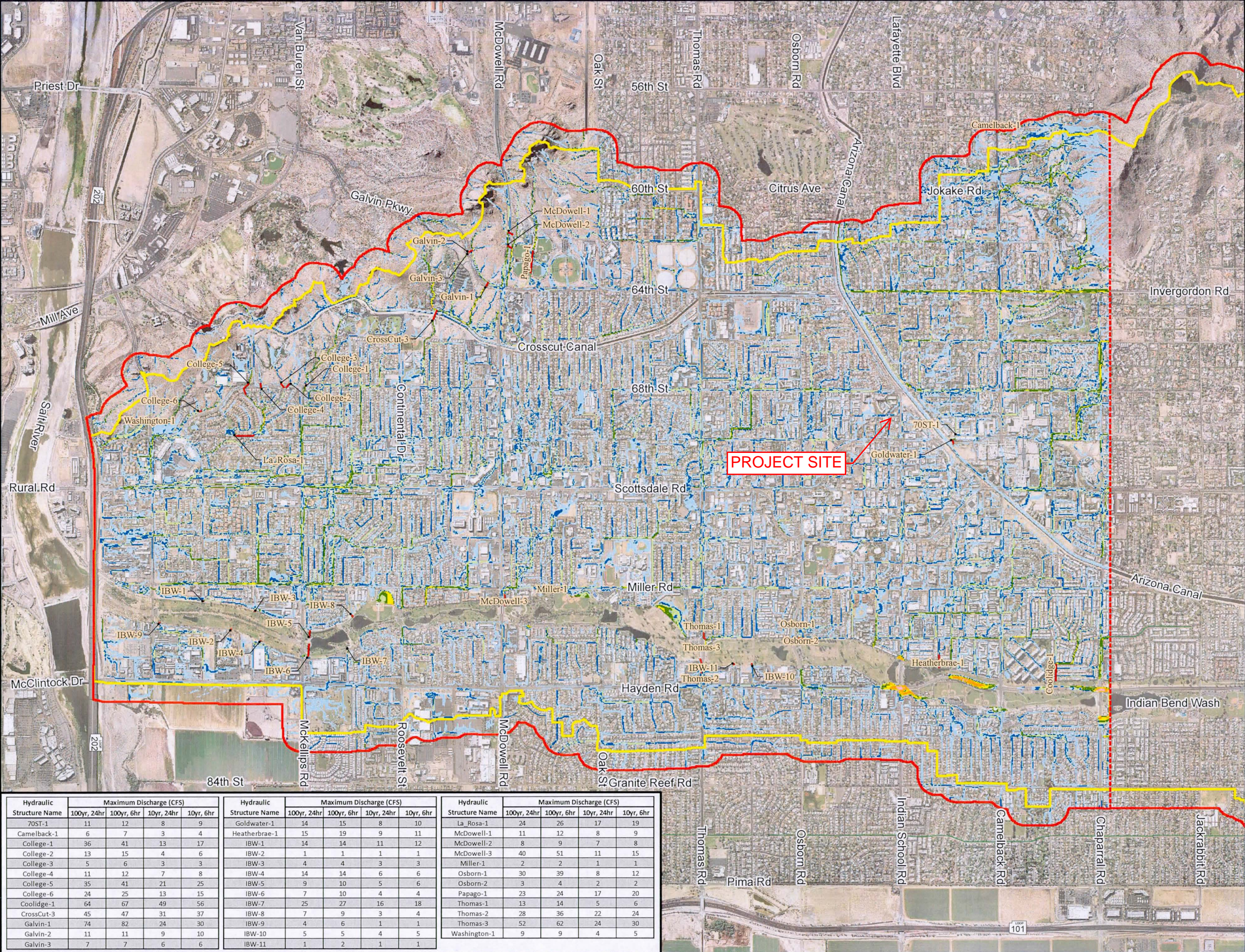
LOWER INDIAN BEND
WASH ADMS/P
STUDY AREA-SOUTH
HYDRAULIC STRUCTURES
RESULTS SUMMARY
EXHIBIT II.2



Gavan & Barker
Civil Engineering & Landscape Architecture
2030 North Central Avenue, Suite 1530
Phoenix, AZ 85012 Phone: 602.260.0031

TYLIN INTERNATIONAL
engineers | planners | scientists

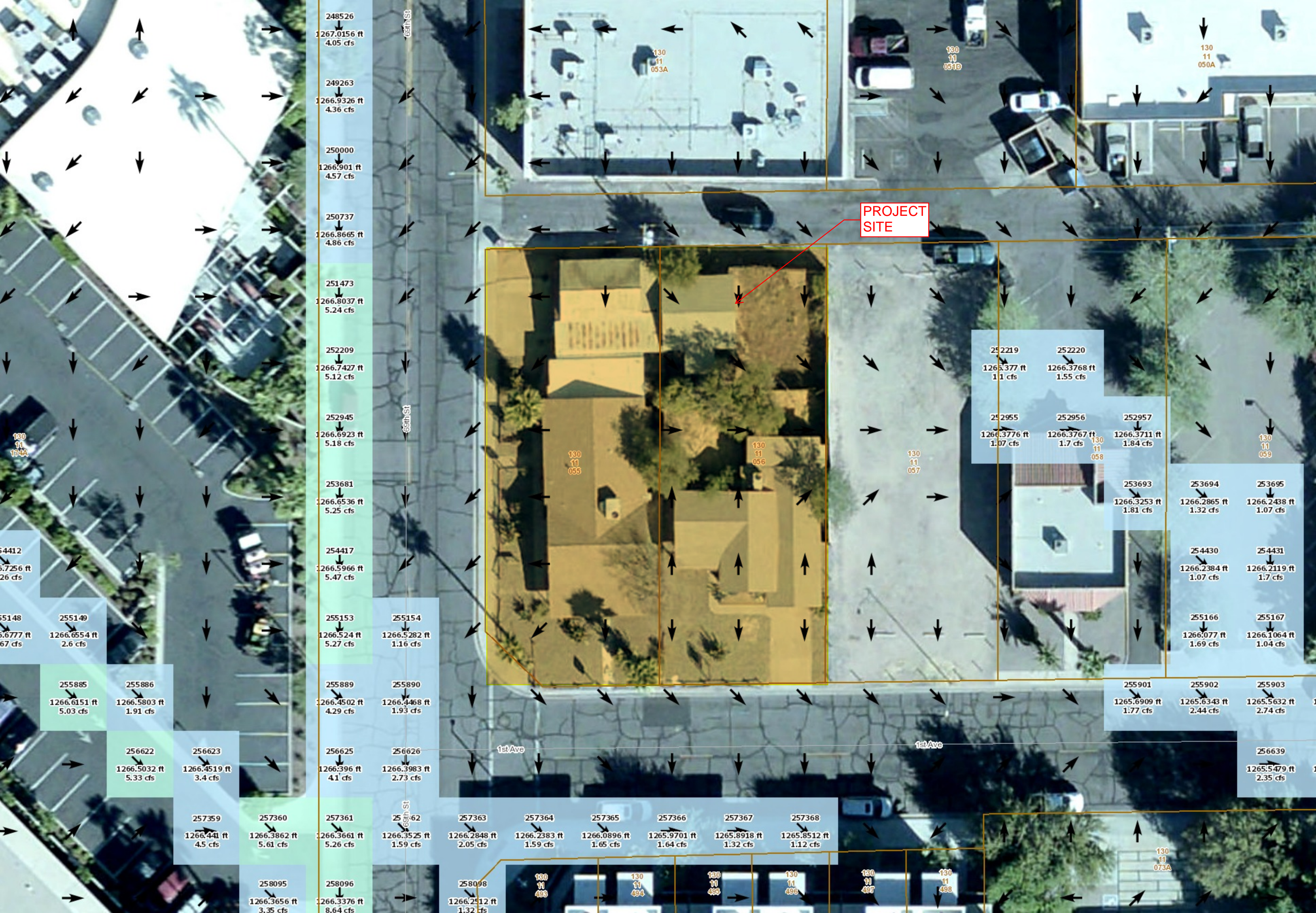
	By	Date
Prepared	AJA/OK	12/14/2017
Checked	MTG	12/14/2017



Hydraulic Structure Name					Maximum Discharge (CFS)				
					100yr, 24hr	100yr, 6hr	10yr, 24hr	10yr, 6hr	
70ST-1					11	12	8	9	
Camelback-1					6	7	3	4	
College-1					36	41	13	17	
College-2					13	15	4	6	
College-3					5	6	3	3	
College-4					11	12	7	8	
College-5					35	41	21	25	
College-6					24	25	13	15	
Coolidge-1					64	67	49	56	
CrossCut-3					45	47	31	37	
Galvin-1					74	82	24	30	
Galvin-2					11	11	9	10	
Galvin-3					7	7	6	6	

Hydraulic Structure Name					Maximum Discharge (CFS)				
					100yr, 24hr	100yr, 6hr	10yr, 24hr	10yr, 6hr	
Goldwater-1					14	15	8	10	
Heatherbrae-1					15	19	9	11	
IBW-1					14	14	11	12	
IBW-2					1	1	1	1	
IBW-3					4	4	3	3	
IBW-4					14	14	6	6	
IBW-5					9	10	5	6	
IBW-6					7	10	4	4	
IBW-7					25	27	16	18	
IBW-8					7	9	3	4	
IBW-9					4	6	1	1	
IBW-10					5	5	4	5	
IBW-11					1	2	1	1	

Hydraulic Structure Name					Maximum Discharge (CFS)				
					100yr, 24hr	100yr, 6hr	10yr, 24hr	10yr, 6hr	
La Rosa-1					24	26	17	19	
McDowell-1					11	12	8	9	
McDowell-2					8	9	7	8	
McDowell-3					40	51	11	15	
Miller-1					2	2	1	1	
Osborn-1					30	39	8	12	
Osborn-2					3	4	2	2	
Papago-1					23	24	17	20	
Thomas-1					13	14	5	6	
Thomas-2					28	36	22	24	
Thomas-3					52	62	24	30	
Washington-1					9	9	4	5	



APPENDIX A-9

Warning and Disclaimer of Liability

The Drainage and Floodplain Regulations and Ordinances of the City of Scottsdale are intended to “minimize the occurrence of losses, hazards and conditions adversely affecting the public health, safety and general welfare which might result from flooding caused by the surface runoff of rainfall” (Scottsdale Revised Code §37-16).

As defined in S.R.C. §37-17, a flood plain or “*Special flood hazard area* means an area having flood and/or flood related erosion hazards as shown on a FHBM or FIRM as zone A, AO, A1-30, AE, A99, AH, or E, and those areas identified as such by the floodplain administrator, delineated in accordance with subsection 37-18(b) and adopted by the floodplain board.” It is possible that a property could be inundated by greater frequency flood events or by a flood greater in magnitude than a 100-year flood. Additionally, much of the Scottsdale area is a dynamic flood area; that is, the floodplains may shift from one location to another, over time, due to natural processes.

WARNING AND DISCLAIMER OF LIABILITY PURSUANT TO S.R.C §37-22

“The degree of flood protection provided by the requirements in this article is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Floods larger than the base flood can and will occur on rare occasions. Floodwater heights may be increased by man-made or natural causes. This article (Chapter 37, Article II) shall not create liability on the part of the city, any officer or employee thereof, or the federal government for any flood damages that result from reliance on this article or any administrative decision lawfully made thereunder.”

Compliance with Drainage and Floodplain Regulations and Ordinances does not insure complete protection from flooding. The Floodplain Regulations and Ordinances meet established local and federal standards for floodplain management, but neither this review nor the Regulations and Ordinances take into account such flood related problems as natural erosion, streambed meander or man-made obstructions and diversions, all of which may have an adverse affect in the event of a flood. You are advised to consult your own engineer or other expert regarding these considerations.

I have read and understand the above. If I am an agent for an owner I have made the owner aware of and explained this disclaimer.

35-DR-2018

Plan Check No.

Nick Prodanov

Owner or Agent

11/12/18

Date